

REMARKS/ARGUMENTS

Claims 6, 7 and 12-15 are active in this application.

The claimed invention provides an ultrasonic sensor comprising: a γ -Al₂O₃ single crystal film epitaxially grown on a semiconductor single crystal substrate; an epitaxial single crystal Pt thin film disposed on the γ -Al₂O₃ single crystal film; a highly oriented ferroelectric thin film disposed on the epitaxial single crystal Pt thin film; and an upper electrode disposed on the ferroelectric thin film; wherein the semiconductor single crystal substrate is subjected to a treatment for adjusting a resonant frequency and an ultrasonic wave to be detected. No such ultrasonic sensor is disclosed or suggested in the cited references.

The rejection of Claim 6 under 35 U.S.C. 103(a) over Pohjonen et al. (U.S. 6,242,843) in view of Higuchi et al. (U.S. 2005/0179342) and further in view of Sakashita et al. (U.S. 2005/0040516) is respectfully traversed.

Applicants respectfully note the Declaration under 37 C.F.R. § 1.131 which is attached to this paper. In this declaration, Inventor Keisuke Hirabayashi provides documents which describe successfully depositing epitaxial Pt (001) films on a γ -Al₂O₃(001)/Si(001) substrate. Mr. Hirabayashi declares that these documents were published prior to December 27, 2002, and therefore reduction to practice of the invention of Claim 6 and claims dependent thereon is established prior to December 27, 2002, the filing date of Sakashita et al.

Accordingly, Applicants respectfully submit that Sakashita does not qualify as prior art and cannot be cited as a reference in support of any rejection.

The combination of Pohjonen and Higuchi does not disclose or suggest the ultrasonic sensor as described in Claim 6 of the claimed invention.

Pohjonen is directed to resonator structures for radio communication apparatus which contains three basic elements: a) an acoustically active piezoelectric layer, b) electrodes on opposite sides of the piezoelectric layer, and c) acoustical isolation from the substrate. The Office has cited Fig. 7 of this reference and alleges that this Figure discloses a structure as described in Claim 6 of the present invention. In Pohjonen's Fig. 7, the bottom electrode (110) is isolated from the substrate (200) by a membrane layer (130). The reference neither discloses nor suggests a crystalline structural relationship interrelating the substrate, membrane layer, bottom electrode and the piezoelectric layer as according to the claimed invention.

In contrast, the claimed invention clearly describes a crystal structure relationship between the semiconductor single crystal substrate, the γ -Al₂O₃ single crystal film, the single crystal Pt thin film and the ferroelectric thin film. The described relationship is that the γ -Al₂O₃ single crystal film is epitaxially grown on the semiconductor single crystal and the single crystal Pt thin film is epitaxial to the γ -Al₂O₃ single crystal film. Applicants have described in the specification that a highly oriented ferroelectric film is obtained when the lower electrode are of single crystal structure with the (001) faces aligned (page 2, lines 20-25).

As established in the paper submitted with the Response filed January 22, 2008, Applicants were the first to actually successfully grow and describe an epitaxial Pt (001) thin

film on a Si (001) substrate using an epitaxial γ -Al₂O₃ (001) buffer layer (Journal of Crystal Growth, 264 (2004) 463-467).

Applicants respectfully note the Examiner's reference to "product by process" limitation. However, Applicants respectfully submit that the phrases "epitaxially grown" and "epitaxial single crystal . . . disposed on" are descriptive of a crystal orientation relationship between the respective single crystal thin films and not process determining. As previously indicated, Applicants respectfully maintain that epitaxial films are films wherein a deposited film takes on a lattice structure and orientation identical to those of the substrate. It is this single crystal orientation relationship between the respective thin films which is described in Claim 6 and this relationship is such that the Pt single crystal of the Pt thin film is epitaxial with respect to the γ -Al₂O₃ single crystal, which is epitaxial to the single crystal of the semiconductor substrate.

The Office has cited Higuchi to show that a single crystal platinum film as an electrode and a well oriented piezoelectric film are well known in the art.

Applicants respectfully point out that neither Pohjonen nor Higuchi discloses or suggests a γ -Al₂O₃ single crystal thin film between the bottom electrode and a substrate having an epitaxial relationship with the substrate and the bottom electrode as described in Claim 6 of the present invention.

The Office has acknowledged this deficiency of the combination of Pohjonen and Higuchi (Page 6, lines 3-4) Sakashita is cited to show epitaxially grown γ -Al₂O₃ film as a buffer layer between a lower electrode and a support substrate.

However, in view of the declaration of Mr. Hirabayashi described above, Applicants respectfully submit that Sakashita is not available as prior art and the deficiency of the combination of Pohjonen and Higuchi cannot be cured.

In view of the above, Applicants respectfully submit that the claimed invention is not rendered obvious by the combination of Pohjonen and Higuchi and withdrawal of the rejection of Claim 6 under 35 U.S.C. 103(a) over Pohjonen in view of Higuchi and further in view of Sakashita is respectfully requested.

Claims 7 and 12-15 all directly or indirectly depend from Claim 6.

The rejection of Claims 7, 13 and 15 under 35 U.S.C. 103(a) over Pohjonen et al. in view of Higuchi et al. and further in view of Sakashita et al. and further in view of Ziegler (U.S. 6,238,946), Ando et al. (2004/0021401) and Tabata et al. (U.S. 5,354,732) is respectfully traversed.

None of the cited references cure the basic deficiencies of the primary references as described above and therefore cannot render these claims obvious.

Ziegler is cited to show use of silicon on insulator (SOI) substrate. Ando is cited to show etching of Si single crystal (100) face and Tabata is cited to show gold black as an electrode material. However, Applicants respectfully submit that none of the cited secondary references disclose or suggest an ultrasonic sensor comprising: a γ -Al₂O₃ single crystal film epitaxially grown on a semiconductor single crystal substrate; an epitaxial single crystal Pt thin film disposed on the γ -Al₂O₃ single crystal film; a highly oriented ferroelectric thin film disposed on the epitaxial single crystal Pt thin film; and an upper electrode disposed on the ferroelectric thin film; wherein the semiconductor single crystal substrate is subjected to a

Application No. 10/549,364
Reply to Office Action of April 17, 2008

treatment for adjusting a resonant frequency and an ultrasonic wave to be detected. Therefore, none of the cited references cures the deficiency of the primary references as described above. Withdrawal of the rejections of Claims 7, 13 and 15 under 35 U.S.C. 103(a) over Pohjonen et al. in view of Higuchi et al. and further in view of Sakashita et al. and further in view of Ziegler (U.S. 6,238,946), Ando et al. (2004/0021401) and Tabata et al. (U.S. 5,354,732) is respectfully requested.

Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

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